

Using of Specialized Food for the Workers with Skin Occupational Eczema of Perlite Production

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Abstract

The studies were conducted with the participation of perlite production workers suffering from occupational eczema (165 people from the main group and 152 people from the comparison group who did not have skin pathology). Given the important role of pathogenetically based and balanced nutrition in the treatment and prevention of a number of skin diseases, one of the promising areas is the development and implementation of qualitatively new food products with a directed change in the chemical composition that meets the needs of workers' organisms exposed to specific adverse working conditions. In addition, the use of specialized products in the complex of preventive measures is aimed at optimizing the adaptive reserves of the working body, reducing vascular permeability, and increasing the body's resistance to toxins. Inclusion of a special food in the diet of the examined subjected to courses of complex therapy has resulted in a positive influence on individual laboratory values, demonstrating the optimization of metabolic processes, which characterize the pathogenesis of skin inflammation.

This led to an increase in the concentration of ascorbic acid in serum, tocopherol, carotenoids and phosphorus. There was a decrease in the level of malonic dialdehyde in serum by 12.3% ($p < 0.05$) and an increase in catalase activity by 12.2% ($p > 0.05$), which indicates the normalization of the equilibrium of the „lipid peroxidation - antioxidant protection” system enhancing adaptive reserves and body resistance to toxins. There was a tendency to decrease skin itching, infiltration, erythematous and eczematous manifestations of the disease. The data obtained allows us to consider the use of a specialized food product of dietary preventive nutrition by workers occupied at perlite production facilities as a means of increasing the adaptive reserves of the body and preventing the occurrence, progression and development of occupational skin diseases (eczema) in the workplace.

Keywords: Perlite Production; Therapeutic Nutrition; Adaptation; Biochemical Parameters; Occupational Diseases; Eczema

Introduction

The research was conducted with participation of the perlite production workers with professional eczema (165 people in the main group and 152 from the control group without skin pathology). Given the important role of pathogenetically grounded and balanced nutrition in the treatment and prevention of a number of skin diseases, one of the promising directions is the development and introduction of new food with directed changes in the chemical composition, appropriate for the needs of the organism of a person working in specific adverse conditions. In addition, the use of specialized products within the range of preventive measures is aimed at optimization of adaptive reserves of the body of the workers, lowering of vascular permeability, enhancing the body's resistance to toxins. Inclusion

of a specialized food product of dietary preventive nutrition in the form of a jelly drink containing pectin, vitamins A, E, zinc, biologically active substances of plant origin in the diet resulted in a positive effect on indicators of nutritional status in patients undergoing courses of complex therapy, which shows optimization of metabolic processes characterizing the pathogenesis of the skin inflammatory process.

Thus, the concentration of many vitamins will be increasing in the blood serum like ascorbic acid statistically significant ($p < 0.05$) increased by 30.0%, tocopherol - by 36.3%, carotenoids by 27.3%, phosphorus - by 28.9%.

There was a decrease in the level of malonic dialdehyde in blood serum by 12.3% ($p < 0.05$) and an increase in catalase activity by 12.2% ($p > 0.05$), indicating a normalization of the balance of the "lipid peroxidation - antioxidant protection" system, which strengthens adaptive reserves and the body's resistance to toxins. There was a tendency to reduction in itching, infiltration, erythematous and eczematous manifestations of the disease. The data obtained make it possible to consider the use of a specialized food product of dietary preventive nutrition by workers in perlite production as a mean to enhance the body's adaptive reserves and to prevent the occurrence, progression and development of occupational skin diseases (eczema) in the workplace.

The frequency of development of allergic dermatoses continues to grow, occupies one of the leading places in the structure of occupational morbidity of workers and has a pronounced socio-economic significance. Analysis of national statistics, as well as epidemiological studies of various scales, indicates that eczema occupies a leading place among occupational allergic dermatoses [1,2].

In general, in the construction industry, skin diseases account for 24 - 37% of cases of the total incidence; while workers are exposed to the combined effects of harmful chemical and physical irritants of allergenic and toxic nature of low intensity in combination with an unfavorable microclimate and dusty air in the working area, which can cause pathological changes on the skin and in the body [1].

It should be noted that the complex and combined nature of the effects of chemicals on the body, the characteristics of toxicokinetics, population and individual sensitivity to chemicals determine the metabolic reactions that determine the prevalence of detoxification or activation of chemical compounds that affect the timing and formation of professional allergic dermatoses.

In the etiology and pathogenesis of occupational eczema, the main role is played by the influence of a certain production factor. Unlike other occupational allergic dermatoses, occupational eczema has an increased delayed-type sensitivity of considerable intensity, as evidenced by pronounced clinical manifestations, as well as more significant changes in allergological and immunological tests. If at the beginning of the disease in patients, hypersensitivity is usually monovalent, then in the future it becomes bi- or polyvalent.

Immunological and morphological studies carried out in the diagnosis of occupational eczema indicate that inflammatory changes in the dermis are not specific and fit into the general pathological characteristics of tissues with nonspecific inflammation.

Under the influence of increased vascular permeability of the predominantly terminal part of the microvasculature, spongiosis of the epidermis develops with the penetration of lymphocytes into it, the clinical and morphological manifestation of which is microvesiculation. Gross changes in the destructive order under the influence of inflammation do not develop, perivascular lymphoid-histiocytic infiltrates of the papillary dermis are noted; while in the peripheral blood a decrease in the number of T-lymphocytes and a decrease in their functional characteristics are recorded. All this indicates the possibility of complete reversibility of inflammatory phenomena [1,2].

In the recent years, it has been shown that the pathogenetic mechanisms of the development of occupational eczema are based on impaired enzyme systems, activation of free radical processes, a decrease in antioxidant defense and immune reactivity that develop under the influence of chemical industrial substances in the early stages of skin pathology, which determines the need for a wide range of applications preventive measures, including the use of pathogenetically based and balanced nutrition [3-7].

The principles of therapeutic and prophylactic nutrition are based on data on the specific effect of individual nutrients on the absorption rate of toxic substances entering the body during production activities on the accumulation of these substances in tissues and their

elimination from tissues and blood. Most toxic substances in the human body undergo transformations during oxidation, reduction and hydrolytic decomposition in the liver and other organs and tissues.

Some chemical compounds or their metabolites react with endogenous molecules and radicals with the formation of non-toxic soluble substances excreted in urine, bile or expired air [4,8,9].

It is extremely important in modern conditions to use biologically active substances that can fulfill a protective role in case of adverse environmental influences on the body [4,9,10]. Also, one of the promising ways to improve the therapeutic and preventive nutrition of workers is the development and implementation of qualitatively new food products with directed change in the chemical composition corresponding to the needs of the body in specific adverse working conditions [5,11,12].

In this regard, the purpose of this study was to assess the effectiveness of using a specialized food product in the nutrition of perlite production workers with occupational eczema based on a study of the dynamics of nutritional and clinical status indicators.

Materials and Methods

The plant Stroyperlit OJSC (Mytishchi, Moscow Region) was selected as the object of research. Natural material perlite is a rock representing volcanic glass. In case of direct production contact with perlite, skin inflammation occurs due to trauma, irritation and blockage of the excretory ducts of the sebaceous and sweat glands of the skin of workers, which, combined with adverse working conditions, determine its dermatopathogenic properties.

The main group (165 people) was made up of workers in the main professions: crushers of heat-insulating raw materials, calciners in the production of heat-insulating materials, sorters (packers) of heat-insulating products with professional eczema exposed to the complex effects of adverse factors of the working environment. All the examined were male, the average age was 53.5 ± 0.6 years, the experience in the perlite workshop was 27.6 ± 0.96 years.

The course of the disease in all the examined main group was moderate, according to the dermatological index EASI (Eczema Area Severity Index). The clinical picture was dominated by the phenomena of severe infiltration, accompanied by cracks, vesicles, weeping; maceration of the stratum corneum, resulting in the formation of foci of various sizes of bright red color, shiny, moist; the color of the skin in the lesions was cyanotic red or brown. The comparison group consisted of workers in similar professions that did not have skin pathology (152 male subjects; average age - 50.4 ± 1.25 years; average experience - 24.6 ± 1.87 years).

The study was carried out for 4 weeks. In addition to the course of therapy according to standardized regimens (antihistamines, desensitizing agents, enterosorbents, external therapy, physiotherapy, etc.), the examined group received daily a specialized jelly dietetic food product "Kozhniy" kissel (LLC "LEOVIT Nutrio", Russian Federation; certificate of state registration RU.77.99.19.004.E.004963.10.16 from 10.31.2016), prepared by stirring 2 tablespoons of the powder (20g) in 1 glass of boiling water (Table 1).

Nutrient	In 100g of dry product	In 1 serving (20g)	
		Content	% of MTP*
Energy value, kcal	350	70	3
Carbohydrates, g	93	19	5
Vitamin A, mg	13,5	2,7	337,5
Vitamin E, ME	30	6	60
Zinc mg	30	6	40

Table 1: Nutritional value of a specialized dietary prophylactic food product.

*: Average daily requirement.

The composition of the test product includes: sugar, potato starch, apple, vegetables (beets, carrots), oatmeal, acidity regulator (citric acid), flavoring (apple); the active ingredients of jelly are represented by a set of dermatotropic plant components that have traditions of food use: licorice root extract (*Glycyrrhiza glabra*), *Rhodiola rosea* L. (*Rhodiola rosea* L.) extract, burdock root (*Arctium lappa*), lemon balm leaf (*Melissa officinalis*), horsetail field grass (*Equisetum arvense*), a series of grass (*Bidens tripartita*), dandelion root (*Taraxacum officinale*). Along with this, the product includes components responsible for inhibiting lipid peroxidation processes in cell membranes (vitamin E), providing local specific and non-specific immunity (vitamin A), and maintaining normal skin condition (zinc).

Patients from the comparison group did not receive the studied product.

During the study, indicators of protein and mineral metabolism and enzyme activity in blood serum were evaluated twice in the subjects of the main and comparison groups using the Metrolab 2300 automatic biochemical analyzer (Metrolab, Argentina) using domestic and foreign test systems.

The provision of the organism with vitamins was assessed by the concentration in the blood serum: ascorbic acid, determined by visual titration, of retinol and carotenoids using the Bessey micromethod in the modification of AA Anisimova, α -tocopherol, using the fluorescence method according to R.Ch. Chernyauskene [13].

Antioxidant status was evaluated by the activity of blood catalase, determined by spectrophotometric method according to MA Koryuk [14], by the content of secondary products of lipid peroxidation - malondialdehyde in the blood according to the method of M Mihara in reaction with thiobarbituric acid [13].

Processing of the obtained data was carried out using the package of statistical functions in the Windows environment. The statistical significance of the differences of the compared values was evaluated by student's criterion.

Results and Discussion

The results of biochemical studies showed that the content of total protein and albumin in the blood serum of the subjects was within normal limits and did not change during the study (Table 2).

The change in the percentage of globulins in protein fractions noted before the start of the study (background period) may indicate an immune rearrangement associated with a change in the activity of the primary immunity unit. At the end of the 4-week course of taking a specialized product, the workers of the main group showed a statistically significant decrease in the relative content of α_2 and γ globulins.

After taking the specialized product, the examined main group showed a tendency to a decrease in the activity of AST and ALT by 4.0 - 5.5 U/L ($p < 0.10$).

Analysis of the initial vitamin supply of workers allowed us to establish the following patterns: a reduced level of ascorbic acid was determined in 67% of the subjects, retinol in 24%, α -tocopherol in 27%, beta-carotene and carotenoids in 70%. However, only 10% of the subjects were fully provided with all the vitamins studied. Deficiency of one of the determined vitamins occurred in 28% of cases, and 55% of the examined had a combined deficiency of two or three vitamins.

While using a specialized product, there was a statistically significant increase in the concentration of α -tocopherol in blood serum by 36.3%, the amount of carotenoids by 27.3% and ascorbic acid by 30%, to a level exceeding the lower limit of normal. The number of polyhypovitaminous states decreased by 1.4 times.

An analysis of the mineral metabolism indices showed that the concentration of macronutrients during the initial examination was close to the lower limit of the norm, which, apparently, is associated with the irrational nutrition of workers or the action of industrial contaminants. Against the background of the use of a specialized product, a significant increase in the concentration of phosphorus by 28.9% ($p < 0.05$) and calcium by 16.3% ($p < 0.10$).

Indicator	Norm	Main group		Comparison group	
		Pre-intervention	After 4 weeks	Pre-intervention	In 4 weeks
Total protein, g/l	65 - 85	77,9 ± 2,3	73,76 ± 2,0	79,3 ± 2,6	76,4 ± 2,1
Albumin, g/l	53 - 66	49,6 ± 3,2	47,6 ± 2,5	48,5 ± 3,4	46,4 ± 2,7
α1 - globulins, %	2 - 4	2,7 ± 0,5	2,9 ± 0,7	2,5 ± 0,4	2,3 ± 0,5
α2 - globulins, %	6 - 9,5	10,1 ± 1,3	9,4 ± 2,1*	9,6 ± 1,3	9,3 ± 1,4
β - globulins, %	7,5 - 13	16,0 ± 2,1	13,6 ± 0,6	14,7 ± 1,3	13,2 ± 1,8
γ - globulins, %	14 - 22	19,1 ± 1,5	17,4 ± 1,1*	18,6 ± 1,6	17,6 ± 1,5
Bilirubin, μmol/L	5,5 - 20,5	12,9 ± 1,5	10,4 ± 2,4*	16,0 ± 2,1	18,8 ± 1,7
Activity ACT, U/L	0 - 40	32,3 ± 2,1	28,3 ± 1,9	31,1 ± 1,9	30,4 ± 2,0
ALT activity, U/L	0 - 40	36,4 ± 1,7	30,9 ± 2,2	37,1 ± 2,3	38,4 ± 1,7
The activity of alkaline phosphatase, units/l	< 117	75,4 ± 2,5	67,8 ± 3,1	83,2 ± 2,9	87,1 ± 2,7
Ascorbic acid, mg/dl	0,7 - 1,0	0,60 ± 0,1	0,78 ± 0,08*	0,61 ± 0,09	0,65 ± 0,07
α-tocopherol, μmol/l	11,6 - 46,4	10,2 ± 1,5	13,9 ± 1,7*	10,1 ± 1,2	10,9 ± 1,3
Retinol, mcg/dl	30 - 70	35,9 ± 2,7	39,0 ± 2,4	34,7 ± 2,3	35,7 ± 2,0
Carotenoids, mcg/dl	80 - 230	67,1 ± 4,0	85,4 ± 4,2*	66,5 ± 2,7	69,9 ± 3,0
β-carotene, μg/dl	20 - 60	15,0 ± 1,3	20,3 ± 1,5	15,3 ± 1,2	16,0 ± 1,5
Phosphorus, mmol/L	0,7 - 1,6	0,76 ± 0,1	0,98 ± 0,14*	0,70 ± 0,09	0,73 ± 0,07
Magnesium, mmol/L	0,7 - 1,0	0,77 ± 0,01	0,84 ± 0,05	0,75 ± 0,03	0,78 ± 0,04
Calcium, mmol/L	2,05 - 2,75	2,15 ± 0,20	2,50 ± 0,03	2,18 ± 0,05	2,30 ± 0,03
Malonic dialdehyde, μmol/L	2,2 - 4,8	5,7 ± 0,3	5,0 ± 0,2*	5,8 ± 0,2	5,5 ± 0,2
Catalase activity, mkkat/l	450 - 850	319 ± 31	358 ± 23	324 ± 29	332 ± 25

Table 2: Dynamics of biochemical parameters in workers at perlite production ($M \pm m$).

*: Statistically significant differences ($p < 0.05$) from the indicator in the background period.

Along with this, as a result of the use of a specialized food product, significant changes were noted in the "lipid peroxidation - antioxidant protection" system. In the main group of workers, the level of malonic dialdehyde in serum decreased by 12.3% ($p < 0.05$), and the activity of catalase increased by 12.2%, although the differences did not reach the level of statistical significance.

Workers with occupational eczema who received complex therapy in combination with the use of a specialized food product showed a tendency to decrease skin itching, infiltration, erythematous and eczematous manifestations of the disease. Adverse reactions and complications of therapy were not observed.

Based on the criteria for the effectiveness of complex therapy for workers with occupational eczema, the group with clinical recovery included 78% of people whose skin manifestations of the disease completely disappeared by the time the specialized food product was used. Other subjects of this group (22%) noted a significant improvement in the condition of the skin with the partial preservation of some clinical symptoms: impaired pigmentation, dry skin and slight peeling.

Conclusion

Based on the results obtained, it can be concluded that the use of a specialized food product of dietary preventive nutrition containing vitamins A, E and zinc and biologically active substances of plant origin is rather high in case of professional eczema in workers at perlite

production. An increase in the supply of workers with vitamins and carotenoids, minerals, an increase in the adaptive reserves of the body in preventing the adverse effects of environmental factors, and a decrease in the intensity of lipid peroxidation were established.

Bibliography

1. Izmerov NF. "The use of modern technology in the laboratory to assess the risk of development and prognosis of occupational allergic dermatoses". Federal Handbook, volume 12 (2012).
2. Izmerova NI., *et al.* "Occupational diseases of the skin such as socio-economic problems of occupational". *Medicine and Industrial Ecology* 7 (2013): 28-32.
3. Istomin AV., *et al.* "Medical-preventive nutrition to optimize the health of workers". *The Health Of The Russian Federation* 5 (2011): 34.
4. Piven NP and Piven EA. "Feeding behavior of patients with chronic dermatoses". Proceedings of the XIV all-Russian Congress of dietitians and nutritionists with international participation (2012): 67.
5. Rakhmanov RS., *et al.* "Efficiency of usage of natural low caloric protein-vegetable product by patients with excess body weight and hypertension". *Voprosy Pitaniia* 83.5 (2014): 64-71.
6. Mazhaeva TV., *et al.* "Characteristics of the diet and nutritional status of workers at various industrial enterprises of the Sverdlovsk Region". *Voprosy Pitaniia* 87.1 (2018): 78-84.
7. Pogozheva AV and Baturin AK. "Proper nutrition is the Foundation of health and longevity". *Pishevaya Promishlennost* 10 (2017): 58-61.
8. Istomin AV., *et al.* "Hygienic problems of correction of nutrition factor in hazardous working conditions". M (2015): 186.
9. Nazarenko GI and Kiskun AA. "Clinical evaluation of laboratory results". M: Medicine (2000): 544.
10. Istomin AV., *et al.* "The evaluation of effectiveness of dietary preventive products in working population". *The Health of the Russian Federation* 6 (2014): 26-29.
11. Pilat TL., *et al.* "Power working in hazardous and very hazardous working conditions. History and modern state". M: LEOVIT-nutria (2006).
12. Pilat TL., *et al.* "Detoxification diet". M: GeOTAR-Media (2012).
13. Kirjakov VA., *et al.* "Clinical laboratory diagnosis of professional diseases". M: Chancellor (2013): 372.
14. Korolyuk MA. "Method for determining the activity of catalase". *Laboratornoe Delo* 1 (1988): 16-18.

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